

## TITLE OF THE INVENTION

Press Button Switch and Method of Manufacturing the Same

### Reference to Related Application

5 This application is a continuation of ~~International Application No.~~  
PCT/JP99/04643, whose international filing date is August 27, 1999, the  
disclosure of which is incorporated by reference herein.

## BACKGROUND OF THE INVENTION

### Field of the Invention

10 The present invention relates to a press button switch and a method  
of manufacturing the same.

### Description of the Background Art

15 In recent years, as for the key top (part exposed from the housing) of  
press button switches used in cellular phones, or the like, a metallic finish  
has been used as a design to impart a feeling of high quality. In the  
following a conventional press button switch comprising the key top with a  
metallic finish design is described.

20 Fig. 15 is a cross-sectional view schematically showing the structure  
of a conventional press button switch. Referring to Fig. 15, the  
conventional press button switch has a plating layer 101, a molded resin  
part 103 and a base rubber 104 making up its main parts. The plating  
layer 101 is formed on the surface of the molded resin part 103 which is a  
base body of the press button. The molded resin part 103 is bonded to the  
base rubber 104 by means of the adhesive layer 106. An actuator part 105  
is formed to be integrated into the base rubber 104. The actuator part 105  
25 is a part which makes the switching possible by pressing a dome-shaped  
metal plate 108.

Here, such a press button switch is arranged on a substrate 107 and  
is arranged so that the key top is exposed from the housing 110.

30 The plating layer 101 comprises, for example, a chemical nickel  
plating layer, an electrolysis copper plating layer, an electrolysis nickel  
plating layer or an electrolysis chromium plating layer.

Conventionally, as described above, a plating is applied onto the  
surface of the molded resin part 103 so that the key top has the metallic

finish design. However, in such a method by means of plating only the color of the metal itself can be selected for the key top design and, therefore, the problem arises that designs cannot be freely created.

5 As for a method of achieving colors which cannot be created by using only the metal itself, there is a method for carrying out a color coating on the top surface of the plating layer 101. However, color coating is inferior in wear resistant properties and easily comes off. Therefore, when the switching operation is repeated, the color coating comes off and the plating layer 101 is exposed so that the problem arises that unevenness of color  
10 occurs.

#### SUMMARY OF THE INVENTION

The present invention provides a press button switch and a method of manufacturing the same which can impart a feeling of high quality through a metallic finish design, of which the design degree freedom is high  
15 and of which color unevenness of the key top can be prevented from occurring.

A press button switch according to the present invention is a press button switch for a switching operation through the pressing of a button which comprises a base body of the button, an undercoat layer which is  
20 formed on the surface of the base body and of which the surface, at least, exhibits a metallic color and a film which is formed over the surface of the undercoat layer so as to cover the undercoat layer and which allows the transmission of the metallic color of the undercoat layer.

According to a press button switch of the present invention, a formed  
25 film is used of which the material quality is superior in wear resistance properties to a coating film. Therefore, the peeling off of the film during usage can be prevented so that unevenness of color due to exposure of the undercoat layer can be prevented from occurring.

In addition, since the film is made of a material which allows the  
30 metallic color of the undercoat layer to be transmitted and, therefore, a metallic finish design can be achieved so as to impart a feeling of high quality.

It is preferable for the film to be a color film in the above described

press button switch.

Thereby, the film can be colored while reflecting the metallic color of the undercoat layer so that the degree of design freedom can be enhanced.

It is preferable for the film to be a colorless film in the above  
5 described press button switch.

Thereby, the metallic color of the undercoat layer can be clearly transmitted.

It is preferable for the above described press button switch to further comprise a layer with transmittance which has a designed pattern between  
10 the undercoat layer and the film.

Thereby, the degree of design freedom can be enhanced.

It is preferable for the undercoat layer to be a metal layer in the above described press button switch.

Thereby, an undercoat layer which exhibits a metallic color can be  
15 formed by means of plating or vapor deposition.

It is preferable for the undercoat layer to be a printed layer where a plate-type finish is applied to the surface in the above described press button switch.

Thereby, a desired plate-type finish design can be gained by means of  
20 printing process so that the degree of design freedom can be enhanced.

It is preferable for the above described press button switch to further comprise a protective film for preventing heat from being conveyed from the base body to the undercoat layer and the protective film is formed between the base body and the undercoat layer.

Thereby, heat can be prevented from being conveyed from the base  
25 body side to the undercoat layer so that color change, or the like, of the undercoat layer can be prevented.

It is preferable for the base body to contain an actuator formed for a switching operation in the above described press button switch.

Thereby, it becomes unnecessary to separately provide an actuator  
30 from the base body in order to simplify the design of the parts.

It is preferable for the base body to have a hollow area in the above described press button switch.

Thereby, it can be designed to be made lighter.

The method of manufacturing a press button switch according to the present invention is a method of manufacturing a press button switch for a switching operation through the pressing of a button which comprises the step of formation of a film with transmittance in a button shape and, through contact with the button shape of a layered film wherein an undercoat layer, of which the surface exhibits a metallic color, and said film are layered, a base body fixed to said layered film is formed.

In a method of manufacturing a press button switch according to the present invention, a press button switch which can impart a feeling of high quality through a metallic finish design with a high degree of design freedom and which can prevent the unevenness of color through frictional wear from occurring can be manufactured by a simple method.

Here, the step of a formation of the film in a button shape may either be the step of formation of, solely, the film into a button shape or the step of a formation of a film and an undercoat layer in the layered condition in a button shape. When the film is formed, solely, into a button shape an undercoat layer is formed following the shape of the film after the formation.

It is preferable for the base body to be formed after the formation of the film into a button shape in the above described method of manufacturing a press button switch.

Thereby, a precise button shape can be gained.

It is preferable for the base body to be formed simultaneously at the formation of the film in a button shape in the above described method of manufacturing a press button switch.

Thereby, the formation of the base body and the formation into a button shape can be carried out simultaneously and the step thereof can be designed to be simplified.

The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a cross-sectional view schematically showing a structure of a press button switch according to the first embodiment of the present invention;

5 Fig. 2 is a view of the molded resin part of Fig. 1 viewed from the lower side;

Figs. 3 to 5 are views showing a method of manufacturing a press button switch according to the first embodiment of the present invention;

10 Figs. 6 and 7 are views showing another method of manufacturing a press button switch according to the first embodiment of the present invention;

Fig. 8 is a cross-sectional view schematically showing a structure of a press button switch according to the second embodiment of the present invention;

15 Fig. 9 is a cross-sectional view schematically showing a structure of a press button switch according to the third embodiment of the present invention;

Fig. 10 is a cross-sectional view schematically showing a structure of a press button switch according to the fourth embodiment of the present invention;

20 Fig. 11 is a cross-sectional view schematically showing a structure of a press button switch according to the fifth embodiment of the present invention;

25 Fig. 12 is a cross-sectional view schematically showing a structure of a press button switch according to the sixth embodiment of the present invention;

Fig. 13 is a cross-sectional view schematically showing a structure of a press button switch according to the seventh embodiment of the present invention;

30 Fig. 14 is a view of the molded resin part of Fig. 13 viewed from the lower side; and

Fig. 15 is a cross-sectional view schematically showing a structure of a press button switch according to a prior art.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the following, the embodiments of the present invention are described in reference to the drawings.

### First Embodiment

5 Referring to Fig. 1, a press button switch has a color film 1a, a plating layer (or vapor deposition layer) 2, a molded resin part 3 and a base rubber 4 making up its main parts. The molded resin part 3 is formed of resin which becomes a base body of the press button. The plating layer (or  
10 layer is formed on the surface of the above molded resin part 3. This plating layer (or vapor deposition layer) 2 is made of simple metal such as Cr (chromium), Al (aluminum), Ni (nickel), Au (gold), Cu (copper) or an alloy of these. Moreover, particularly Cr or Al among these metals exhibits a silvery metallic color so as to be able to make the pattern of the  
15 color film 1a more vivid than other metal materials. A molded color film 1a is provided on this plating layer (or vapor deposition layer) 2. The color film 1a has the desired color for design and has the property to allow metal color of the plating layer (or vapor deposition layer) 2 to transmit. This color film 1a comprises moldable materials, such as resin, including  
20 polymer compounds such as PET (polyethylene terephthalate), PC (polycarbonate), urethane or combinations of these.

The molded resin part 3 is bonded to the base rubber 4 via the adhesive layer 6. The adhesive layer 6 comprises, for example, thermosetting adhesive or UV adhesive. The base rubber 4 comprises, for  
25 example, silicon rubber and has an actuator (protruding part) 5 which is integrated. The actuator 5 is a part which makes the switching operation possible by the pressing of a dome shaped metal plate 8 supported by the substrate 7.

The key top of this press button switch is exposed from the housing  
30 10 so that the switching operation is carried out by pressing this key top part.

Here, the molded resin part 3 may have the structure wherein a hollow area 3a is provided as shown in Fig. 2 or may have a solid structure

without the hollow area 3a. Here, it is preferable to provide the hollow area 3a for the purpose of weight reduction.

Next, a process of the present embodiment is described.

Referring to Fig. 3, first a layered film is prepared by forming a plating layer (or vapor deposition layer) 2 through, for example, plating or vapor deposition on the back surface of the color film 1a with transmissibility which has a desired color for design. At this time, in the case that the plating layer 2 is formed it is preferable to use Cr as the material and in the case that the vapor deposition layer 2 is formed it is preferable to use Al.

Referring to Fig. 4, this layered film 1a, 2 is press molded by using a mold 21, 22 and, thereby, is molded into a substantially curved form in a button shape. Here, the molding method is not limited to the above described method and the film may be molded into a substantially curved form through a vacuum molding.

Referring to Fig. 5, the molded layered film 1a, 2 is fitted into a mold 23, 24 for injection molding. After that the molded resin part 3 is formed by making resin flow in from the gate 24a of the mold 24.

After that, the desired parts of the layered film 1a, 2 are cut off and then bonded to the base rubber 4 via the adhesive layer 6 as shown in Fig. 1. As for the material for this adhesive layer 6 thermosetting adhesive, for example, can be used and, in addition, UV adhesive can also be used. Thereby, a press button switch of the present embodiment as shown in Fig. 1 is manufactured.

Though, in the above described method, injection molding of resin is carried out after the layered film 1a, 2 is molded into a substantially curved form, this molding of the material into a substantially curved form and the injection molding of the material may be carried out simultaneously. In the following this method is described.

The layered film 1a, 2 gained by the step as shown in Fig. 3 is sandwiched in the mold 25, 26 as shown in Fig. 6. After that, resin is injected from the gate 26a of the mold 26 as shown in Fig. 7. Through the injection pressure of this resin, the layered film 1a, 2 is molded into a

substantially curved form and the molded resin part 3 is formed. Though in this case, the molded resin part 3 has a solid structure without a hollow area, a hollow area may be provided through the following processing.

After that, in the same was as is above described, a press button switch of the present embodiment is manufactured by bonding the molded resin part 3 to the base rubber 4 via the adhesive layer 6 as shown in Fig. 1.

In the present embodiment, the surface of the plating layer (or vapor deposition layer) 2 is covered with a color film 1a which comprises polymer compounds, or the like, with high wear resistance. Thereby, the peeling of the color film 1a can be prevented and the color unevenness due to the partial exposure of the plating layer (or vapor deposition layer) 2 can be prevented from occurring.

In addition, the color film 1a comprises the material which allows the metallic color of the plating layer (or vapor deposition layer) 2 to transmit so as to enable the achievement of a metallic finish design and to impart a feeling of high quality.

In addition, it is possible to color the color film 1a so as to enable the enhancement of the degree of design freedom through the coloring.

#### Second Embodiment

Referring to Fig. 8, a press button switch of the present embodiment is different from the structure of the first embodiment as shown in Fig. 1 in the point that a protective film layer 11 is added. This protective film layer 11 is provided between the molded resin part 3 and the plating layer (or vapor deposition layer) 2, and comprises, for example, polymer compounds such as PET, PC, urethane or combinations of these.

Here, the structure of other parts is approximately the same as in the above described first embodiment the same parts are referred to by the same numerals of which the descriptions are omitted.

According to a process of the present embodiment first a layered structure of the color film 1a, the plating layer (or vapor deposition layer) 2 and the protective film layer 11 is prepared. After that, injection molding may be carried out after molding into a substantially curved form as shown in Figs. 4 and 5 or injection molding may be carried out at the same time as



molding into a substantially curved form as shown in Figs. 6 and 7.

In the present embodiment a protective film layer 11 is provided between the molded resin part 3 and the plating layer (or vapor deposition layer) 2. Therefore, heat can be restrained from being conveyed to the plating layer (or vapor deposition layer) 2 at the time of injection molding for the formation of the molded resin part 3 so that the color change, or the like, of the plating layer (or vapor deposition layer) 2 due to heat can be prevented.

Here, even in the case that a printed layer or a coating layer is provided instead of the protective film layer 11 the same effects as those in the present embodiment can be gained.

#### Third Embodiment

Referring to Fig. 9, a press button switch of the present embodiment is different from the structure as shown in Fig. 1 in the point that a printed layer (or coating layer) 12 and a transparent film 1b are formed on the plating layer (or vapor deposition layer) 2. This printed layer (or coating layer) 12 has a desired design and has the property which allows the metallic color of the undercoat plating layer (or vapor deposition layer) 2 to be transmitted. The printed layer (or coating layer) 12 has a desired design applied with ink or paint. The transparent film 1b is colorless and has the property that allows the undercoat color to be transmitted. This transparent film 1b comprises moldable material, such as resin, including, for example, polymer compounds such as PET, PC, urethane or combinations of these.

Here, the other parts of the structure are almost the same as in the above described first embodiment and, therefore, the same parts are referred to by the same numerals of which the descriptions are omitted.

According to a process of the present embodiment, first a layered structure of the transparent film 1b, the printed layer (or coating layer) 12 and the plating layer (or vapor deposition layer) 2 is prepared. After that, injection molding may be carried out after molding the material into a substantially curved form as shown in Figs. 4 and 5 injection molding may be carried out simultaneously to mold the material into a substantially

curved form as shown in Figs. 6 and 7.

In the present embodiment a transparent film 1b which comprises polymer compounds, or the like, of which the wear resistance is higher than that of a coating film is provided. Therefore, peeling of the transparent film 1b can be prevented so that the color unevenness due to the exposure of the undercoat layer can be prevented from occurring.

In addition, since a printed layer (or coating layer) 12 is used, the metallic color of the plating layer (or vapor deposition layer) 2 can be reflected while the degree of design freedom can be enhanced.

In addition, since the transparent film 1b and the printed layer (or coating layer) 12 comprises materials which have transmissibility the metallic finish design of the plating layer (or vapor deposition layer) 2 can be reflected while imparting a feeling of high quality.

#### Fourth Embodiment

Referring to Fig. 10, a press button switch of the present embodiment is different from the structure of the third embodiment in the point that a protective film layer 11 is added. This protective film layer 11 is provided between the molded resin part 3 and the plating layer (or vapor deposition layer) 2 and comprises, for example, polymer compounds such as PET, PC, urethane or combinations of these.

Here, the other parts of the structure are almost the same as in the above described third embodiment and, therefore, the same parts are referred to by the same numerals of which the descriptions are omitted.

According to a process of the present embodiment, first a layered structure of the transparent film 1b, the printed layer 12, the plating layer 2 and the protective film layer 11 is prepared. After that, injection molding may be carried out after molding the material into a substantially curved form as shown in Figs. 4 and 5 or injection molding may be carried out simultaneously to mold the material into a substantially curved form as shown in Figs. 6 and 7.

In the present embodiment, a protective film layer 11 is provided between the molded resin part 3 and the plating layer 2 and, therefore, heat can be restrained from being conveyed to the plating layer 2 at the time of

injection molding for the formation of the molded resin part 3 so that color change, or the like, of the plating layer (or vapor deposition layer) 2 due to heat can be prevented.

Here, even in the case that a printed layer or a coating layer is provided instead of the protective film layer 11, the same effects as in the present embodiment can be gained.

#### Fifth Embodiment

Referring to Fig. 11, a press button switch of the present embodiment is different from the structure of the first embodiment in the point that a plating finish printed layer 12a and a transparent film 1b are provided on the molded resin part 3. The plating finish printed layer 12a has the plating finish and exhibits a metallic color. The transparent film 1b is colorless and has the property that allows the metallic color of the plating finish printed layer 12a to be transmitted. This transparent film 1b comprises moldable material such as resin and comprises, for example, polymer compounds such as PET, PC, urethane or combinations of these.

Here the other parts of the structure are almost the same as in the above described first embodiment and, therefore, the same parts are referred to by the same numerals, of which the descriptions are omitted.

According to a process of the present embodiment, first a plating finish printed layer 12a is provided on the back surface of the transparent film 1b. After that, injection molding may be carried out after molding the material into a substantially curved form as shown in Figs. 4 and 5 or injection molding may be carried out simultaneously to mold the material into a substantially curved form as shown in Figs. 6 and 7.

In the present embodiment the plating finish printed layer 12a is provided so that it is not necessary to provide a plating layer (or vapor deposition layer), and a design with metallic finish can be achieved. In addition, the plating finish printed layer 12a can express a variety of types of plating finish through printing so as to enable the enhancement of the degree of design freedom.

#### Sixth Embodiment

Referring to Fig. 12, a press button switch of the present embodiment

is different from the structure of the fifth embodiment in the point that a protective film layer 11 is added. This protective film layer 11 is provided between the molded resin part 3 and the plating finish printed layer 12a and comprises, for example, polymer compounds such as PET, PC, urethane or combinations of these.

Here, the other parts of the structure are almost the same as in the above described fifth embodiment and, therefore, the same parts are referred to by the same numerals, of which the descriptions are omitted.

According to a process of the present embodiment, first a layered structure of the transparent film 1b, the plating finish printed layer 12a and the protective film layer 11 is prepared. After that, injection molding of the material may be carried out after molding the material into a substantially curved form as shown in Figs. 4 and 5 or injection molding of the material may be carried out simultaneously to mold the material into a substantially curved form as shown in Figs. 6 and 7.

In the present embodiment, since a protective film layer 11 is provided between the molded resin part 3 and the plating finish printed layer 12a, heat can be restrained from being conveyed to the plating finish printed layer 12a at the time of injection molding for the formation of the molded resin part 3.

Here, even in the case that a printed layer or a coating layer is provided instead of the protective film layer 11, the same effects as in the present embodiment can be gained.

#### Seventh Embodiment

Referring to Figs. 13 and 14, a press button switch of the present embodiment is different from the structure of the first embodiment in the point that an actuator part 5 is provided to be integrated in the molded resin part 3 and in the point that the base rubber is omitted. Therefore, in the present embodiment, the switching operation is carried out through the pressing of the dome shaped metal plate 8 by the actuator part 5 provided to be integrated into the molded resin part 3.

Here, the other parts of the structure are almost the same as in the above described first embodiment and, therefore, the same parts are

referred to by the same numerals, of which the descriptions are omitted.

According to a process of the present embodiment, a layered structure of the color film 1a and the plating layer 2 is prepared so as to be molded into a substantially curved shape as shown in Fig. 3 and, after that,  
5 the molded resin part 3 is formed to be integrated into the actuator part 5 in the injection molding step as shown in Fig. 4.

In the present embodiment, since the actuator part 5 is provided to be integrated into the molded resin part 3, the base rubber becomes unnecessary and the number of parts can be reduced.

10 Here, in the first to seventh embodiments, though after preparing the layered structure of the film 1a, 1b, the plating layer 2 (or a plating finish printed layer 12a) and the like the molding thereof into a button shape is carried out, the single layer of the film 1a, 1b is molded into a button shape and, after that, the plating layer 2 (or a plating finish printed layer 12a), a  
15 protective film layer 11 or a printed layer 12 may be formed through the contact with the shape of the film 1a, 1b.

As described above, a press button switch according to the present invention can be advantageously applied as a press button switch wherein a feeling of high quality through a metallic finish, a high degree of design  
20 freedom and prevention of color unevenness are required.

Although the present invention has been described and illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the spirit and scope of the present invention being limited only by the terms of the  
25 appended claims.